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SANITATION OF RURAL WORKMEN'S AREAS.

WITH SPECIAL REFERENCE TO HOUSING.

This report contains much valuable and practical information.

It is especially useful as a textbook for beginners in welfare supervision. The details set forth should serve as a guide to executives in welfare work who have not specialized in rural sanitation.

L. A. COOLIDGE,
Chairman Committee on Welfare Work of Committee on Labor,
Council of National Defense.

The following is a report of the divisional committee on village and public sanitation, section on sanitation, committee on welfare work of the committee on labor, advisory commission, Council of National Defense.

This report is published by permission of Mr. Samuel Gompers, chairman of the committee on labor.

The divisional committee on village and public sanitation follows:

George M. Kober, chairman, professor of hygiene, Georgetown University.
John W. Kerr, surgeon, United States Public Health Service.
Lawrence Veiller, secretary National Housing Association.
Charles H. Verrill, Bureau of Labor Statistics, Department of Labor.
William C. Woodward, health officer, District of Columbia.

In contemplating problems of rural housing with special reference to the stress upon industry on account of the war, two sets of conditions may be expected to arise:

(1) The sudden enlargement of existing industries and workmen's residence areas.

(2) The establishment of new industrial plants and residence areas and their mushroom growth.

GENERAL REMARKS AS TO SANITATION OF ENLARGING AREAS.

In enlarging existing areas there will be found certain insanitary conditions which must be remedied before a constructive system of health supervision can be adopted. The best use must be made of areas in or near the existing location, and where possible such areas must be made sanitary.

But although there is less choice as to location in the case of enlarging areas, new buildings should be located on as high and dry ground as possible, due attention being paid to the need of drainage and the desirability of taking advantage of natural fall for this purpose. In those damp and wet areas already built over, thorough drainage must be provided. Location of new buildings should also take into account the availability of a potable water supply and the possibility of connecting with sewers or of the construction of new sewers.

SELECTION OF NEW VILLAGE AND CAMP SITES.

An elevated site should be preferred because of better natural drainage, purer air, freedom from dampness, and greater safety from inundations. It should be remote from breeding places of mosquitoes. "Made soils" should be avoided for building sites, especially because of a series of cases of carbon-monoxide poisoning which have recently occurred in buildings of a construction camp, situated on an old dump, in which combustion continued at considerable depths.[1]

PREPARATION OF THE SITE.

The site should be properly graded to facilitate the removal of surface water. In localities where the ground water is close to the surface, proper grading and ditching around the tents or temporary shacks are necessary, and in camps or villages of a more permanent character, subsoil drainage is required.

LAYING OUT OF STREETS.

Streets should be laid out with due regard to exposure to sunlight and the prevailing winds. A southeast-northwest and a northeast-southwest or a true meridian are the directions generally preferred. Too great a proportion of the lot should not be used for building purposes. Ample space should be left both front and rear and at the sides for light and ventilation. In camp sites the problem of exposure to sunlight and air is generally solved by placing the tents or shacks with intervals between them of at least one and a half of their height. (Fig. 1.)

In village planning the possibility of future expansion and permanency should be kept in mind and suitable provisions made for public squares, parks, and playgrounds.

IMPROVEMENT OF STREETS.

A properly graded and well surfaced (or even cinder) roadway not less than 18 feet in width, to accommodate vehicular traffic, with 2-foot gutters and 3-foot sidewalks, is extremely desirable. Space should be reserved between the gutter and sidewalk, or on the building lot, for shade trees and lawns. The character of the material selected for roadbeds and sidewalks will naturally depend upon the availability and cost of the material. Bulletin 87, Department

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[1] Albaugh, R. P., J. A. M. A., Apr. 7, 1917, p. 1033.

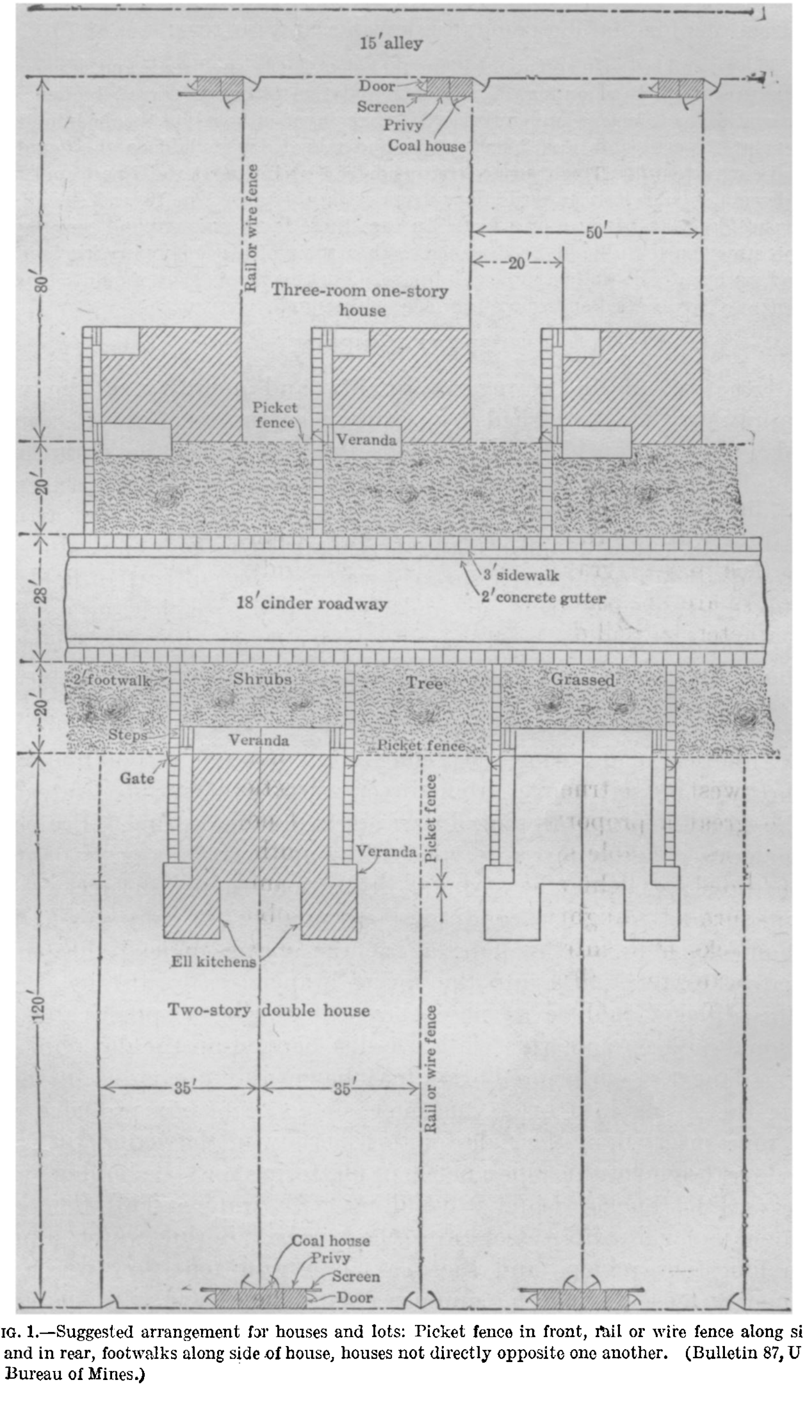

FIG. 1.—Suggested arrangement for houses and lots: Picket fence in front, rail or wire fence along sides and in rear, footwalks along side of house, houses not directly opposite one another. (Bulletin 87, U. S. Bureau of Mines.)

of the Interior, Bureau of Mines (1914), page 11, gives the following directions for making cement sidewalks and gutters:

> The ground is leveled off about 10 inches below the finished grade and, if necessary, is well settled by ramming. A 5-inch foundation of coarse gravel, broken stone, or coal ashes is placed and rolled. A 3-inch layer of concrete, made from 1 part cement, 2 parts sand, and 3 parts stone and mixed dry, is laid on the foundation and covered with a 1-inch surface coat made of 1 part cement and 1 part sand. The sidewalk should drain towards the gutters, with a slope of 1 in 10, and should have expansion joints every 5 or 6 feet. In case there is no underground sewer system the street gutters should be designed with a view of also removing kitchen slops and wash water as well as surface drainage. For this reason they should be made of concrete, box-shaped and smooth surface, with rounded corners.

WATER SUPPLY.

Exact standards as regards quality and quantity of the water supply will be furnished by another committee, but it appears advisable to consider the methods for preventing the pollution of potable water for isolated houses and villages lacking a general supply. Briefly, it may be stated that spring water, deep or artesian well water, and upland streams are regarded as potable, rain water stored underground and surface water from cultivated fields are looked upon with suspicion, and river water to which sewage gains access and shallow wells are considered dangerous. Preference should be given to main springs and artesian or deep-well water.

Springs.

Pollution of a spring may come from seepage of polluted water through the soil above, from direct washing of surface water into the spring, or from dipping dirty vessels into the spring. Protection against seepage is best accomplished by not locating a privy or stable on the slope above the spring. Protection against surface washing will depend upon the conditions surrounding the spring. A ditch should be dug on the slope above the spring to lead the surface water around it and into the spring branch a safe distance below. This ditch should be as close above the spring as practicable, but should be deep and wide, with the dirt banked on the downhill side. The danger of surface pollution may be entirely prevented by inclosing the spring in a brick, masonry, or concrete box provided with a pipe inserted in the side for the overflow of the water. (Fig. 2.) Under the end of this pipe a bench or platform should be built on which to set the bucket while it is filling with water. This renders it unnecessary to dip vessels into the spring. Spring water supplies in limestone regions and those of an intermittent flow which frequently cease during the summer must be regarded with suspicion.

Artesian and Deep Wells.

To protect an artesian or deep well, one must see that the well driller, when the bore is first put down, carries the lining for some

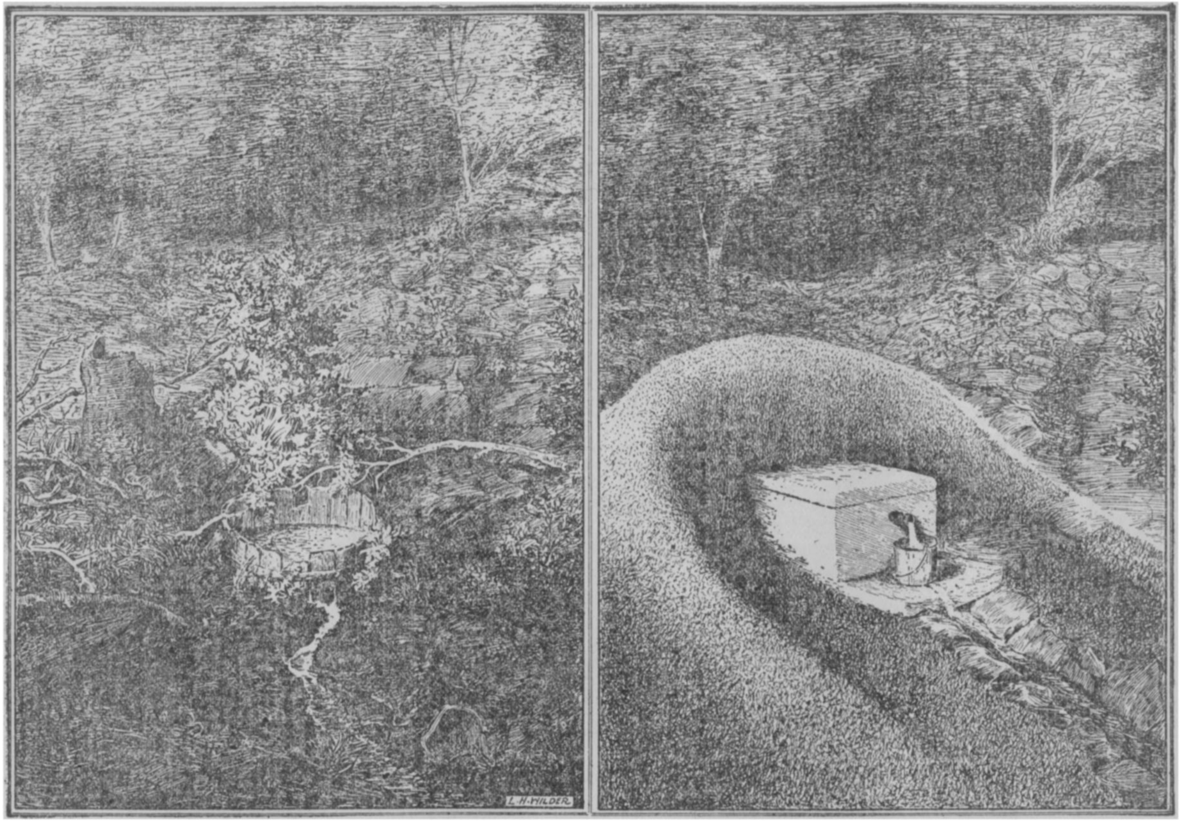

FIG. 2.—Pollution and protection of a spring. The spring on the left receives pollution by washings into it from the slope above and from the soil immediately around it. It may also be polluted by dirty vessels dipped into it. The spring on the right is protected against surface washings by the ditch and by the concrete spring box. It is inclosed and provided with a discharge pipe so that vessels need not be dipped into it. It furnishes water as pure as when it comes from the ground, unmixed with surface water or filth. It should furnish pure water.

distance into the rock, and that the joints in the pipe are screwed up tight. The well platform should be properly braced. It is an excellent idea to raise the surface of the ground about the well and to cover that part immediately about the top with a water-tight platform.

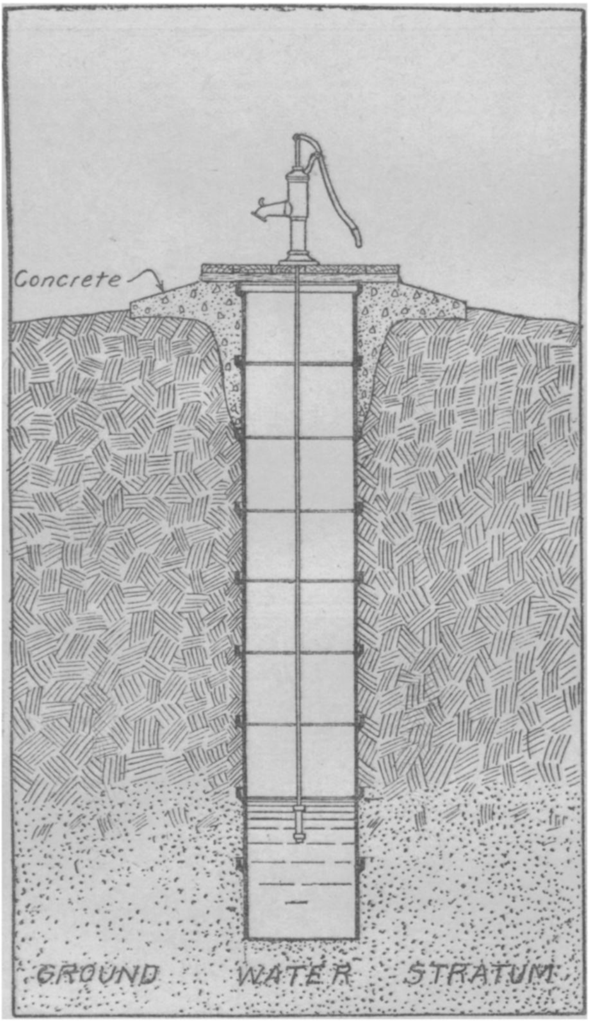

FIG. 3.—A model well, cased with terra-cotta pipe, curbed with concrete, and provided with a water-tight platform and a pump. The water from such a well is unmixed with surface water or filth. Properly located such a well should furnish safe and healthful water. (Virginia Health Bulletin, vol. 3, No. 4, 1911.)

Surface Wells and Cisterns.

In the case of surface wells and cisterns, such a water-tight platform is essential. It may be made either of matched boards or of heavy timbers with the cracks calked with oakum and tar; or, better still, it may be of concrete or cast iron. Any water-tight construction substantial enough to stand the weather and the weight put upon it will suffice. Special precaution must be taken to keep the joint at the foot of the pump or about the base of the windlass box water-tight. The curb may be of brick or masonry laid in cement mortar or it may be of concrete. It should extend at least 2 feet into the ground and rise at least 1 foot above the surface. The earth should be banked up around it so that surface water will be shed promptly. The casing may be of brick or stone laid in cement, of reinforced concrete or of terra-cotta sewer pipe with cemented joints. It must be absolutely water-tight down to the level of the ground water.

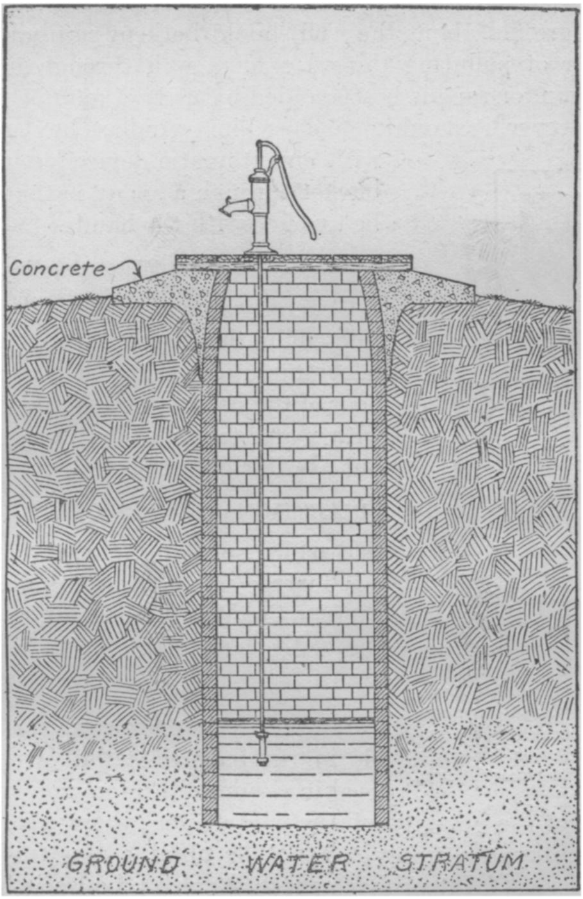

FIG. 4.—A model well, cased with brick laid in cement mortar, and properly graded, curbed, and protected. (Virginia Health Bulletin, vol. 3, No. 4, 1911.)

The location of the shallow well is of the greatest importance. It should be above any source of pollution (privies, pigpens, stables, etc.) and as far from it as possible. If the water is pumped to a tank and piped to the house and outbuildings, the well should be located in an open field 100 yards or more from the dwelling, stable, or privy. If not, the area occupied by the well should be inclosed and the precautions for preventing surface pollution rigidly carried out. The ground about the well should be kept scrupulously clean. The danger of polluting the water of a well through handling the bucket, chain, or rope is best avoided by using a pump. If a bucket is used, however, it should be inclosed in a windlass box and provided with an automatic device for emptying the bucket through a spout so that it need not be touched with the hands.[1]

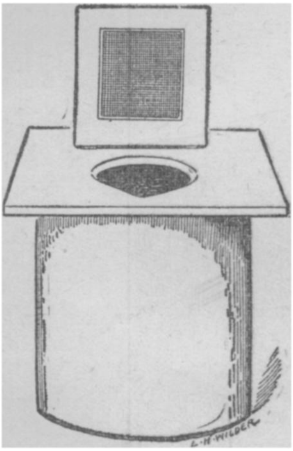

FIG. 5.—Covered can. The simplest type of sanitary receptacle privy. Used with a suitable drying powder, or disinfectant solution, it may be kept sanitary and practically odorless. The seat should be provided with cleats on the under surface to hold it in place on the can.

General Water Supplies.

General water supplies will not be considered in this report, except to say that in communities having such supplies every floor of the habitations should be provided with water taps, not only for convenience, but also for greater safety in case of fire.

COLLECTION AND DISPOSAL OF EXCRETA.

Broadly speaking, there are two methods for the safe collection and disposal of excreta—namely, the sanitary privy and the water carriage methods.

Sanitary Privy.

Sanitary privies are especially applicable in rural districts, but are sometimes used in communities for economic reasons, on account of the severity of the winters, or where a proper grade or a sufficient water supply can not be obtained for the removal of refuse by sewers. Pit privies, where the privy house is built over a hole dug in the ground and is moved to a new position after the pit is filled, can not be classed as sanitary, because of the danger of pollution of underground water, and the use of such privies is condemned. The only kinds of privies which may be classed as sanitary are those with either removable receptacles (tonneaux or box privy, pail system, incinerating system, etc.) or stationary receptacles from which the excreta or an effluent are to be removed. It may be stated that in ordinary habitations there should be at least one privy seat for every 10 persons or less.

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[1] More detailed information as to water supplies for rural districts and villages without a general water supply will be found in Public Health Bulletin No. 70, U. S. Public Health Service (Good Water for Farm Homes, by A. W. Freeman).

Removable-receptacle privies.—There are several satisfactory types of these privies. The covered can type consists of a stout water-tight can fitted with a wooden top having a suitable hole in it to serve as the seat. (Fig. 5.) The hole in the seat is covered by a hinged lid. The seat board is closely fitted to the top of the can and the lid fits closely over the hole. To provide ventilation, the lid may be a framed screen.

The boxed-can type consists of a suitable water-tight receptacle, incased in a box which serves as the seat. (Fig. 6.) The receptacle may be a can, pot, or other water-tight vessel. For purposes of ventilation and easy removal, it is advantageous to have a space of about 2 inches between the top of the receptacle and the under surface of the seat and between the sides of the receptacle and the box. The box must be fly-tight and substantially built. The lid should be hinged at the back or to one side of the hole. It should be arranged to drop into place of its own weight when the privy is not in use. The top or front of the box should be hinged to permit removal of the receptacle for cleaning. Such a commode may be placed in a privy house or in any other suitable building, such as a barn or woodshed, and is thoroughly practicable for use. The boxed receptacle may also be made a part of the structure of the privy house, the back and sides of the house serving as parts of the box.

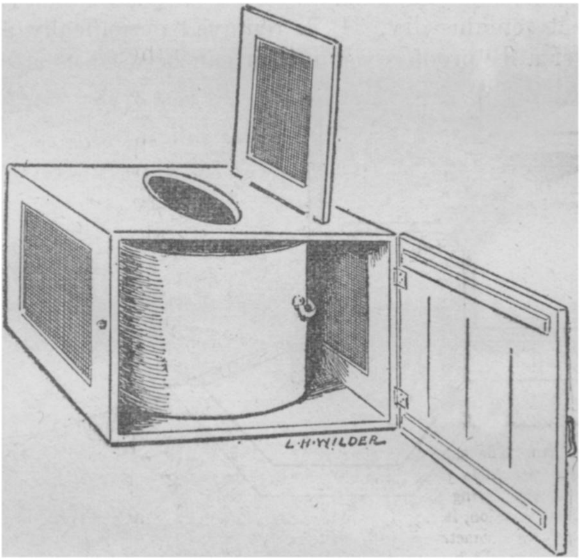

FIG. 6.—The boxed receptacle. Flies are excluded by the fly-tight box. Ventilation is provided by screened openings in the sides of the box and in the lid. The hinged front permits ready removal of the can for cleaning. Such a device is safe, sanitary, and convenient, and may be placed in an existing privy house or in any suitable outbuilding.

The box should be well ventilated to remove objectionable odors. This may be done by means of screened openings in the seat cover and the sides of the box, or, better still, by a ventilating flue from the box to the outside. This flue may be one made of boards, or a triangular flue made by nailing a board upright in the angle formed by one side and the back of the privy house. The opening of the flue in the box should be screened against flies. As a further means of preventing markedly disagreeable odors from the privy contents, as well as making the matter safe and less disagreeable for removal and final disposal, the use of drying powders, such as lime, dry earth, and ashes, or a disinfectant is approved. In the case of the earth closet, dried and sifted earth is retained in a hopper above and about 1½ pounds falls on the excreta when the plug is pulled up. This is sufficient to remove all smell and form a compost which is inoffensive as long as it remains dry. It is removed periodically and may be stored under a fly-proof cover until it can be used as a fertilizer and promptly ploughed under the soil. Such compost should never be used as a superficial fertilizer. For large camps strong boxes lined with sheet iron and long enough for six seats can be placed on low trucks and hauled directly to the fields.

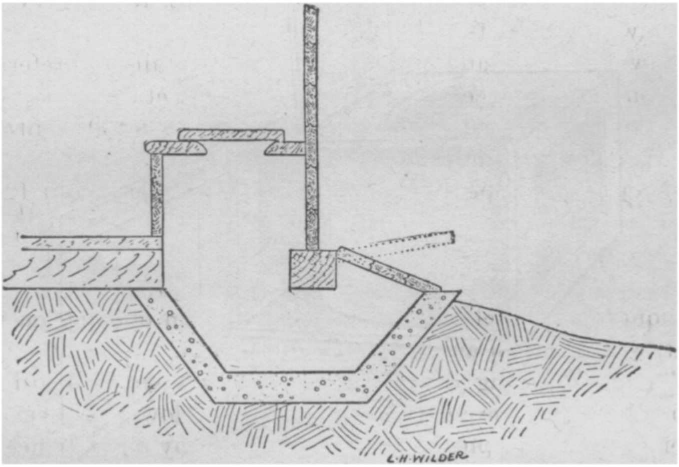

FIG. 7.—A stationary-receptacle sanitary privy with a cement vault arranged for convenient cleaning.

If the privy is installed on an alley in a village or town and is to be cleaned by a public scavenger, the box should be arranged to open in the back of the privy, so that it may be cleaned from the alley. In such a case, it is also advisable to have the receptacles of the same size, so that the scavenger may replace the full cans with the empty cans and take the former, after covers have been placed securely upon them, to the point of disposal.

Stationary-receptacle privies.—If the receptacle does not have to be removed from the privy for emptying, it may be of large capacity, and thus the frequency of disposal of contents may be lessened. (Fig. 7.)

The receptacle may be of wood, iron, or concrete. Concrete is the most durable and, in the long run, the cheapest. The vault must be water-tight. Preferably it should be built wholly or partly below the surface of the ground to prevent freezing. The water-closets may drain directly into it, or else by means of soil pipes and drains. The same principles of fly-proofing, ventilation, and the use of drying powders and disinfectants apply to this as to the removable-receptacle privy. The construction should be such that the excreta will be accessible for safe and cleanly removal. Even if these precautions are taken, the vault system can be regarded as only fairly satisfactory.

If human excreta are permitted to undergo natural fermentation, the solid matter becomes liquefied and a considerable proportion of the excrement and urine is carried away by evaporation and gas formation. Thus the labor and cost of disposing of the matter may be lessened. These principles are applied in the L. R. S. privy,[1] (Figs. 8 and 9), which consists of the following parts:

(1) A water-tight tank, barrel, or other container (preferably of iron or concrete) to receive and liquefy the excreta.

(2) A covered water-tight can, pot, barrel, or other container to receive the effluent or outflow.

(3) A connecting pipe about 2½ inches in diameter, about 12 inches long, and provided with an open T at one end, both openings of the T being covered with wire screens.

(4) A tight box, preferably zinc lined, which fits tightly on the top of the liquefying barrel. It is provided with an opening on top for the seat, which has an automatically closing lid.

(5) An antisplashing device, consisting of a small board placed horizontally under the seat about an inch below the level of the transverse connecting pipe. It is held in place by a rod, which passes through a hole in the side of the seat and by which the board is raised and lowered. A layer of chips floated in the tank may be used instead of this device.

(6) A ventilating pipe, such as a stovepipe or wooden flue, connecting the space under the seat with the open air.

The liquefying tank is filled with water up to the point where it begins to trickle into the effluent tank. A pound or two of old manure should be added to the water to start fermentation. As an insect repellant a film of some form of petroleum may be kept on the surface of the liquid in each container. Water must be added to the liquefying tank from time to time, to prevent the matter from becoming too thick. Disinfectants must not be used in the liquefying tank because they stop the fermentation; but they may be used to good advantage in the effluent tank. The effluent is to be regarded as potentially dangerous and must be disposed of accordingly.[1]

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[1] Lumsden, Roberts, and Stiles: "Preliminary note on a simple and inexpensive apparatus for use in the safe disposal of night soil." Public Health Reports, 1910, Nov. 11, v. 25 (45), pp. 1623-1629. Stiles and Lumsden: The sanitary privy, Farmers' Bulletin 463 (U. S. Department of Agriculture), pp. 17-21. Lumsden: Public Health Bulletin No. 51, pp. 46-49.

Final disposal.—Final disposal of privy contents is important, and it varies with the type and method of operation of the privy. Privy contents may be disposed of (1) by burning, (2) by discharge into a sewer, (3) by burial, either with or without disinfection by heat or chemicals.

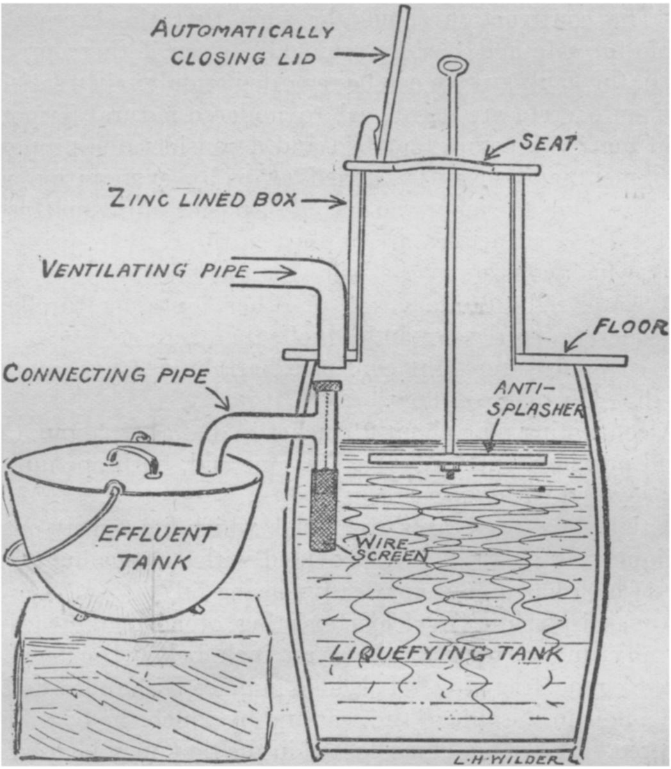

FIG. 8.—An L. R. S. privy with an ordinary vinegar barrel used as a liquefying tank and an iron pot for effluent tank.

Water Carriage System.

The sanitary privy does not provide for the removal of slop waters, which are usually carried by a kitchen drain into sumpt holes, a cesspool or dry well, or into an open ditch or stream. For very temporary camps there is no serious objection to such methods of disposal. In more permanent camps these wastes should be disposed of in furrows of a garden spot, or run into concrete street gutters. A realization of the fact that the waste waters from domestic and industrial plants are quite as likely to prove a source of danger as the fecal discharges has brought the sewerage or water carriage system into deserved prominence. For permanent camps or villages a well-planned sewerage system must go hand in hand with a public water supply.[1]

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[1] Suitable plans for latrines will be found in the Military Surgeon for May, 1917, pp. 507-508, and the Advisory Pamphlet on Camp Sanitation and Housing, Commission of Immigration and Housing of California, pp. 27, 29, 31, 33, 35, 36. Public Health Bulletin No. 68 (Safe Disposal of Human Excreta at Unsewered Homes, by L. L. Lumsden, C. W. Stiles, and A. W. Freeman) will give additional information in regard to this subject.

COLLECTION AND DISPOSAL OF GARBAGE AND OTHER REFUSE.

For the reception of garbage, every camp or household should be provided with galvanized-iron, water-tight cans, with tightly-fitting lids to keep out flies and vermin. These cans should preferably be two feet or more in height where the owner can afford them. Other cans should be provided for ashes and sweepings. Where the refuse is to be incinerated, however, it may be collected in a single can, as is frequently done abroad. The cans should be removed regularly at public expense. Stable manure should be placed in fly-proof manure pits and removed as often as necessary to points designated. The collection of waste paper and other rubbish should be conducted along economical lines.

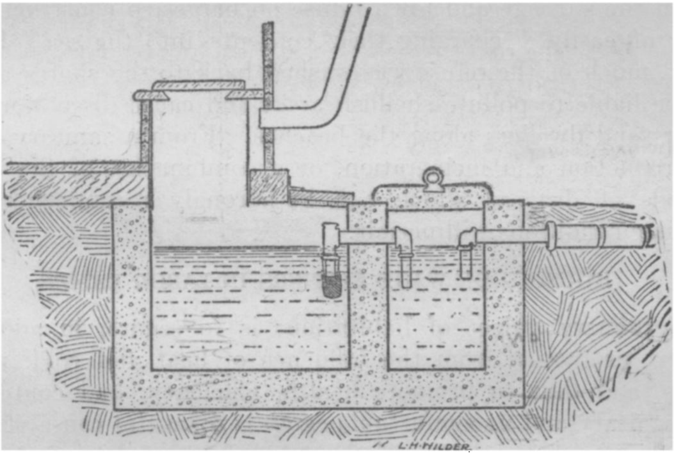

FIG. 9.—An L. R. S. privy with tanks made of concrete and with direct distribution of effluent into top soil.

Disposal in Rural Districts.

In rural districts the garbage is very properly fed to swine and poultry, but this procedure is justifiable only when householders have deep yards and maintain the premises in a sanitary condition. Where garbage is to be collected from a number of houses and fed to swine it should be free from broken glass and other injurious foreign matter. Garbage and other refuse in rural districts may also be used as a fertilizer or as fuel. When used for the latter purpose, in order to obviate offensive odors and enhance its fuel value, the garbage should first be strained for the removal of liquids and then placed for drying in a perforated receptacle in a hot-air chamber which has been devised in connection with the lower part of the kitchen stovepipe.

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[1] Standards for sewer systems and sewage disposal were presented by another subcommittee.

In communities where there is no demand by farmers for garbage or manure, special incinerators have been designed for the combustion of these wastes.[1] A suitable place should be provided for the disposal of ashes, cinders, and street sweepings. Such material may be utilized in filling up swamps and overflowed lands, which, although unsuitable for building sites, are well adapted for public parks and playgrounds.

Disposal in Towns.

In former years it was deemed perfectly proper in seaport towns to load the garbage and town refuse on barges so constructed as to admit of easily discharging their contents into the sea. Unfortunately, much of the refuse was washed back to the shores and thus became liable to pollute shellfish areas and cause discomfort to the bathers and dwellers along the beaches. From a sanitary point of view reduction and incineration, or a combination of the two, are methods of disposal which can be strongly recommended when economic conditions will permit.

HOUSING OF WAGE EARNERS IN LABOR CAMPS.

The primary object of habitations is to secure, in addition to privacy, protection from the influence of heat and cold, rain and storms, and thus to promote health, efficiency, and contentment. An insanitary and uncomfortable camp is a fruitful cause of disease, discontent, and instability of the labor force and has even led to riots. The excellent effects of proper housing conditions on the health of the laborers were conclusively demonstrated at Panama. It is well known that overcrowding favors contact and droplet infections from tuberculosis, pneumonia, influenza, septic sore throat, etc. The negro laborers on the Isthmus of Panama suffered very greatly from diseases of the respiratory organs, especially pneumonia, amounting at times to an epidemic. Gen. Gorgas scattered the men from large and overcrowded barracks into single huts and small rooms, with not less than 50 feet of floor space for each person, and reduced the pneumonia rate in a single year from 18.4 per 1,000 to 2 per 1,000.

Report of Industrial Commission of Wisconsin.

To give an appreciation of the unsatisfactory conditions of labor camps generally, the report of the Industrial Commission of Wisconsin

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[1] For excellent improvised plans, see the Military Surgeon, May, 1917, p. 500-508.

(1914) may be briefly referred to. About 50,000 of the wage earners of the State were housed in camps. Overcrowding was practically universal. In railroad, lumber, ice, sugar beet, paper mill, dock workers', and construction camps the air space per capita was from 90 to 200 cubic feet, the average being about 125. The standard for air space is 500 cubic feet. Less room might be tolerated if the ventilation were good, but such was seldom found to be the case. In the box cars which housed the railroad gangs there was practically no circulation of air and the cars were always ill smelling. In the ice camps most of the rooms were heated by coal stoves and used for sleeping, living, smoking, and washing and drying clothes;

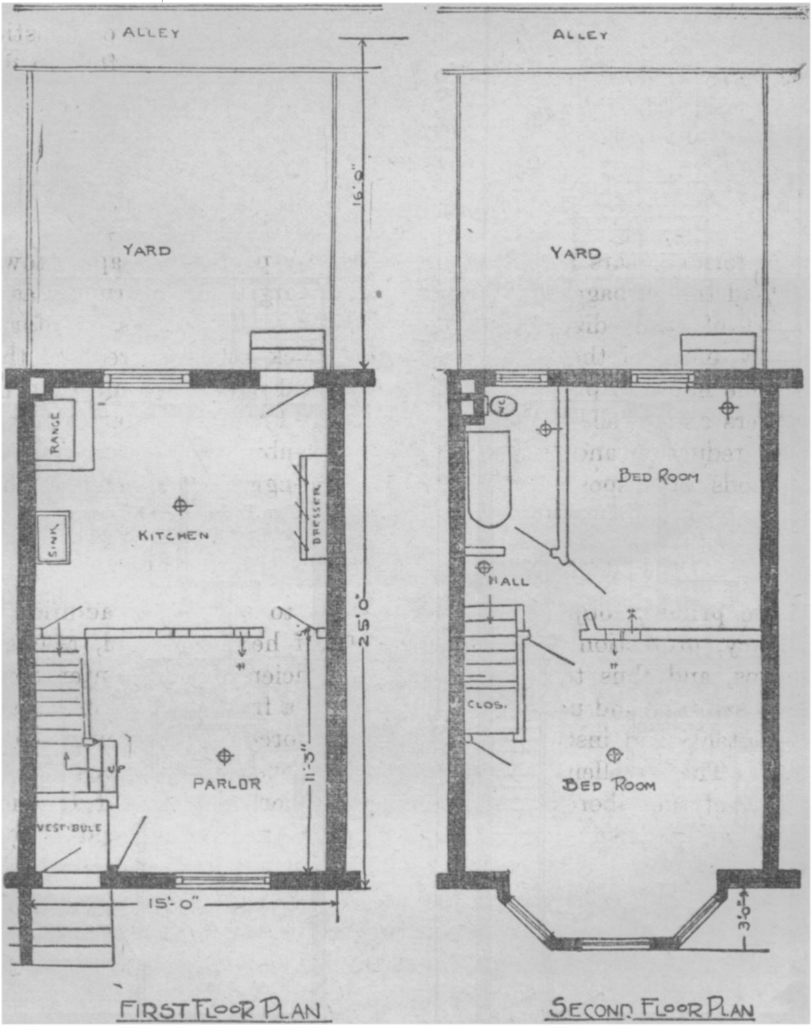

FIG. 10.—A house for each family—the Philadelphia type. Two-story brick houses, 4 rooms and bath. Selling price, $1,750. Rent, $13 a month.

the windows were seldom opened. Where rooms are used for both living and sleeping, more air space per capita is necessary. Conditions similar to these were found in the other camps.

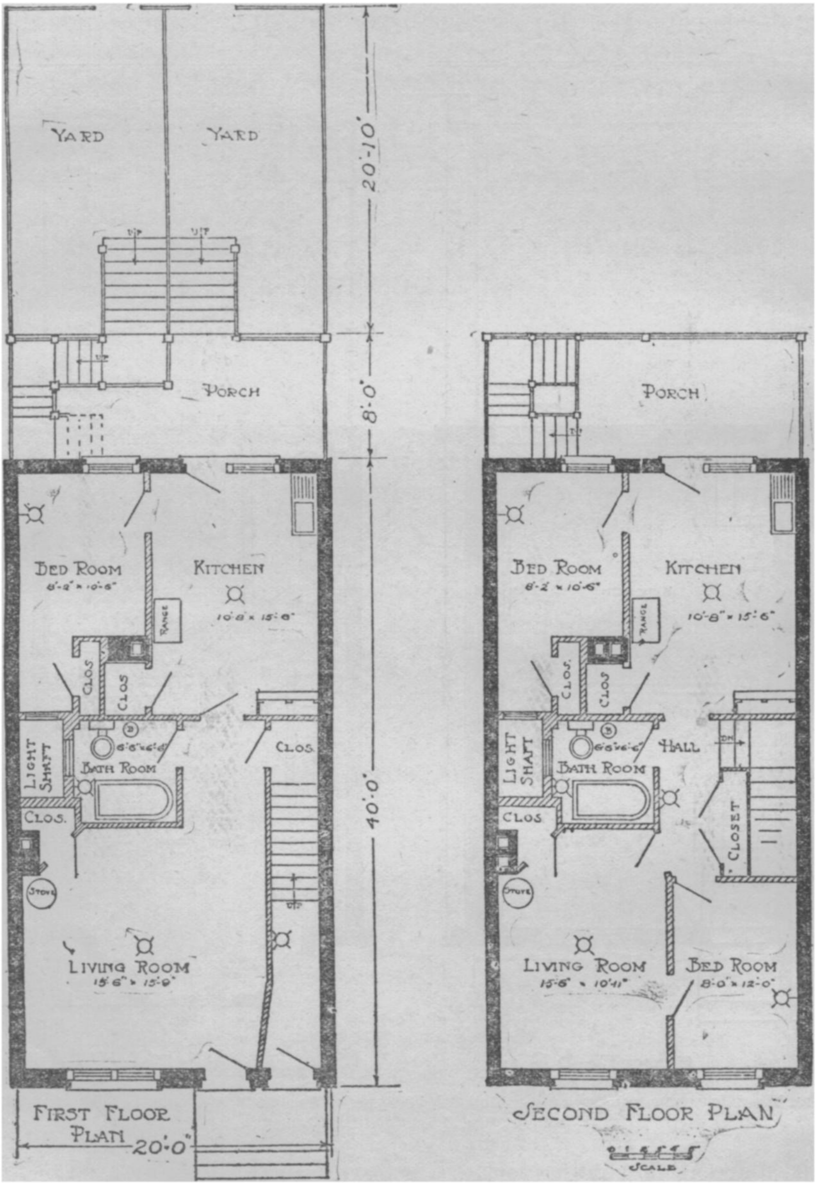

FIG. 11.—Two flat houses of the Washington Sanitary Improvement Co. Rent, $10 for first floor; $12 for second floor.

Few of these places were screened against flies. The kitchens were dirty and the flies in them almost intolerable. Sleeping conditions were bad, and the men frequently complained that their bunks were full of vermin. In some camps no toilet facilities whatever were provided; in some the privy consisted of a shelf placed on the ground with no vault dug; and in others the vaults were overflowing but still in use. Water was frequently taken from wells near such privies.

The Wisconsin commission reports that the replies from seven cities, where more or less complete records have been kept of the place of origin of contagious diseases, show that within a period of three years 159 cases of typhoid, 12 cases of smallpox, 6 cases of diphtheria, 5 cases of measles, 3 cases of scarlet fever, 1 case of meningitis, and 19 cases of erysipelas could be traced to insanitary conditions in labor camps. Most of the cases reported came from the lumber camps and the next largest number from the railroad camps.

Survey of the Commission of Immigration and Housing of California.

On August 3, 1913, a riot occurred on a hop ranch near Wheatland, Cal., and the commission of immigration and housing concluded, after an investigation, that probably the most important contributory factor was the poor housing and sanitary accommodation afforded the workers. Further investigations made it clear that the Wheatland hop ranch conditions were not exceptional, but that similar insanitary housing conditions prevailed pretty generally throughout the labor camps of the State.

Camp Structures.

On account of their rapidly increasing cost and perishable nature, tents are being replaced by portable houses, not only for sleeping quarters, but also for kitchen and mess houses.

Portable buildings.—For temporary camps a portable building properly designed and constructed has many advantages over tents, railway cars, and other types of housing. They are usually turned out in standard sizes and may be constructed of wood, metal, asbestos material, or a combination of these materials. Those made entirely of metal are considered to have the advantages of long life and of being fire proof and relatively vermin proof, but are more expensive than wooden structures, somewhat heavier, inconvenient to replace in case of breakage and deterioration, hot in summer and cold in winter.[1] When made principally of wood they are less expensive, much cooler in summer, lighter and easier to move and handle, but subject to damage or destruction by fire, more difficult to keep clean and free from vermin, and shorter lived.

It is claimed for the asbestos building construction that it can be erected in a short time by unskilled labor. The sections are secured together by patent metal sheet connectors. No fastenings are required through the sheets, so that when knocked down the parts are in perfect condition for reerection. The sheets are of standard size, at present 8 feet by 21 inches, but this may be changed to conform to a standard specification of the buildings. Only one screw or bolt is required in the top and bottom ends of the metal sheet connectors.

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[1] Bulletin 414, U. S. Department of Agriculture, Office of Public Roads and Rural Engineering.

The material is considered absolutely fireproof, vermin proof, and waterproof, and not affected by sudden changes in temperature. The walls are perfectly smooth and the buildings can be easily fumigated and heated, and are also cool in summer. No painting or plastering is required.

Bulletin 414, Department of Agriculture, Office of Public Roads and Rural Engineering, states on page 136:[1]

> Whatever material be used in the construction, the following desirable features should be embodied in the design:
>
> (1) The sections of which the building is composed should be of such size as to permit convenient hauling and erecting. They should not be too large for transportation on an ordinary wagon bed, and in weight they should not exceed approximately 200 pounds, the maximum weight which can be handled successfully by two men in erecting and tearing down.
>
> (2) The sections should be so designed and the connections so made as to secure the maximum of flexibility in the building and permit ready reduction or increase in capacity to accommodate any number of inmates.
>
> (3) All parts and sections should be constructed by template or pattern, in order that similar parts may be absolutely interchangeable.
>
> (4) All units should be so simple in design that they may be constructed by relatively inexperienced labor. Complicated joints, irregular shapes, and difficult cuts should be avoided.
>
> (5) All the parts should be so-called stock articles or easy to improvise, in order that the cost may be reduced to a minimum and that renewals may be made with the greatest ease.

Standards for Air Space.

The minimum amount of air space to be allowed for each inmate should be given careful consideration. In 1912 the United States Public Health Service, in connection with the sanitation of Government buildings, Washington, D. C., determined on a minimum standard of floor space of 50 feet and at least 500 cubic feet of air space, the distance between any two workers sitting opposite one another at a desk to be not less than four feet. These figures obtain in both naturally and artificially ventilated buildings.

In spite of the fact that newer theories in ventilation have been advanced since these standards were agreed upon and that authorities are of the opinion that deficient air space is in part compensated for by the maintenance of proper temperature, humidity, and motion of the air, it has seemed advisable not to alter the standards promulgated, especially in view of our knowledge concerning the dissemination of many infectious diseases through the medium of secretions and contact through overcrowding.

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[1] In Bulletin 414 will be found a general plan for a portable building suitable for temporary camps. The Office of Public Roads and Rural Engineering, United States Department of Agriculture, is prepared to furnish upon application complete detailed plans and specifications.

The area of windows should be at least one-tenth of the floor space and in order that the light may penetrate all parts of the room, the windows should reach almost to the ceiling. The windows should be double sash, and for good ventilation such sash should slide up and down. Double-deck iron bunks with woven-wire mattresses may be used in semipermanent camps, but the space between the two tiers should not be less than 3 feet. The use of sleeping quarters in relays should be prohibited except in case of urgent necessity, and then only after thorough cleaning and airing. All camp structures except those of a most temporary character should have tongued and grooved wooden flooring at least 12 inches aboveground and placed upon suitable piers.

The plans and specifications of all buildings should be drafted so as to make them harmonious, and such plans should be subject to official approval before use. The buildings, after completion and occupancy, should be inspected regularly by the respective health authorities. By this means owners will be aided in securing cleanliness, the prevention of the obstruction of ventilation, and general camp sanitation.

PERMANENT HOUSES.

Preliminary Considerations.

The housing of the workers has very properly been made the subject of legislation in many countries and is a matter in which employers, employees, and the general public should be deeply interested. There are several systems of workmen's dwellings, viz, individual houses or cottages, a row of houses under one roof, and the so-called flats or tenements. Everyone recognizes the advantages of an independent house for every family, no matter how humble, and if this home can be in the country, or in a district where each house is entirely separate from all others and has its own yard and, if possible, a small garden, so much the better. Such ideal conditions may be attainable in industrial villages even for the unskilled laborer; but where real estate values render this impracticable, the problem of providing sanitary homes at reasonable rentals has been met in certain cities by the erection of two-story houses in blocks, each to accommodate a single family. The Philadelphia type of houses is illustrated and described in a paper by Miss Helen L. Parrish entitled: "One Million People in Small Houses," published by the National Housing Association in 1911 (No. 7). The plan (Fig. 10) provides four rooms and bath and can scarcely be improved upon. The Washington sanitary housing companies have limited their operations to the erection of two-story houses with two independent flats. There is nothing in common. Each tenant has a separate entrance and exit and a back yard opening upon an alley in the rear (Fig. 11). On a frontage of 60 feet the company can build three of its modern type houses accommodating six families and renting (six flats) for $66 per month. In the Philadelphia plan the same frontage would be occupied by four houses, accommodating four families and renting for $52 per month. The cost of three of the Washington houses, including land, would be about $7,200. The cost of the four single-family houses, as given by Miss Parrish, would be $7,000. The cost of the lot may be a factor in deciding whether the houses should be of the one-family or two-family type. The Washington four room and bath flat rents for $12 per month, while the Philadelphia plan gives the same number of rooms for $13 a month. If the land is already expensive, the argument for the two-family house is strengthened, especially when houses are built in blocks. Apart from lower rents, there is also economy in heating, since the kitchen range heats the entire apartment sufficiently except in extremely cold weather, when a small coal stove in the front room is used.

In large communities where the value of real estate compels the erection of tenements over two stories in height, the State should insist upon hygienic requirements as regards air space, light, and ventilation. No home can be considered sanitary where one room has to answer the purpose of a living room, sleeping room, and kitchen, or where the water-closet and bathroom are used by more than one family.

Houses for Mining Towns Also Suitable for Industrial Villages.

Bulletin 87, Department of the Interior, Bureau of Mines, prepared by Joseph H. White, supplies most valuable facts on the erection of well-lighted, well-ventilated, warm, attractive, and economical houses. While primarily intended to be units of a mining village or town, they are equally appropriate for any other industrial villages or individual enterprises. The bulletin offers valuable suggestions for the selection of a new isolated town site, the arrangement of the streets, the situation of the houses, and the house itself. Many of these suggestions are applicable to improving conditions in existing towns, in building new houses in old towns, or in repairing old houses. Emphasis is placed on the fact that as a rule a mining village has a shorter life than an industrial town, but it is stated that economy should be distinguished from cheapness, since "a cheerful, strong, healthy, virile race will not rise out of the filth and squalor of cheap hovels." A strong plea is made, however, for true economy upon the assumption that the miner himself is to pay for all that he gets and that the

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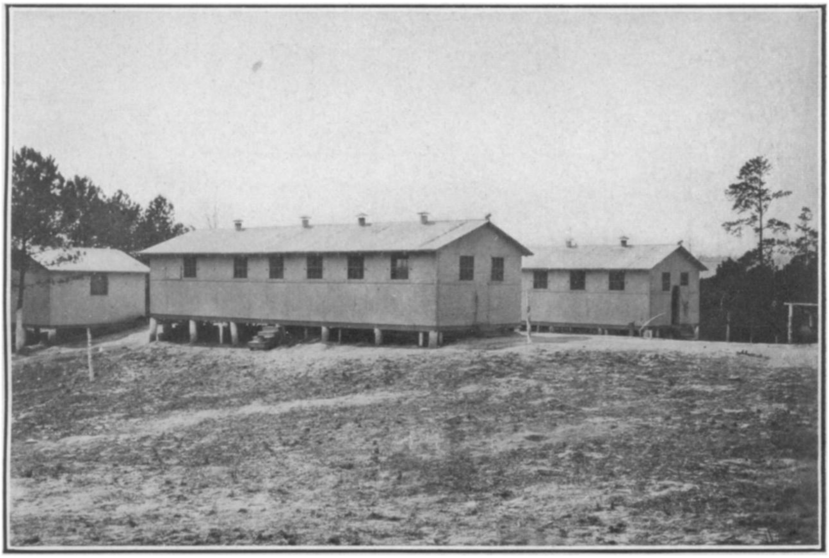


FIG. 12.—PORTABLE BUILDINGS.

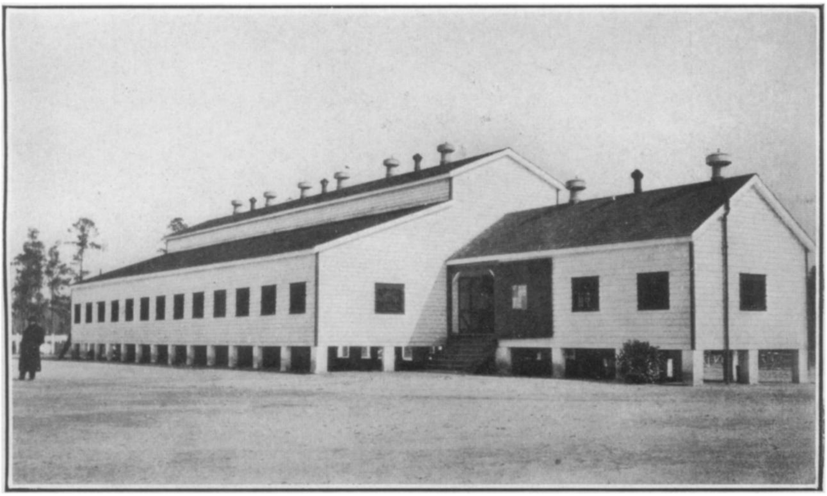
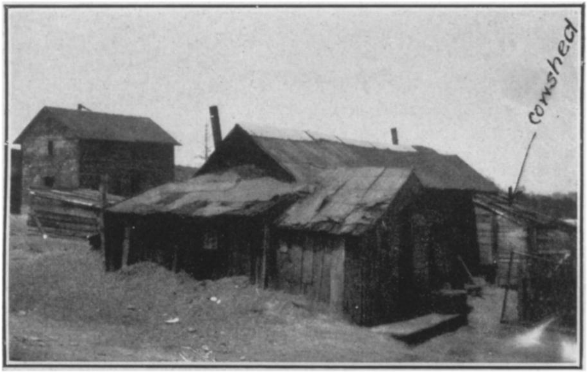
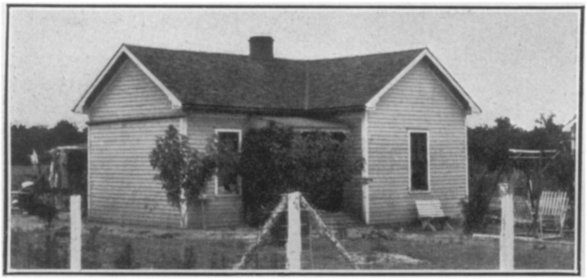


FIG. 13.—PERMANENT FRAME QUARTERS OF GOOD DESIGN.

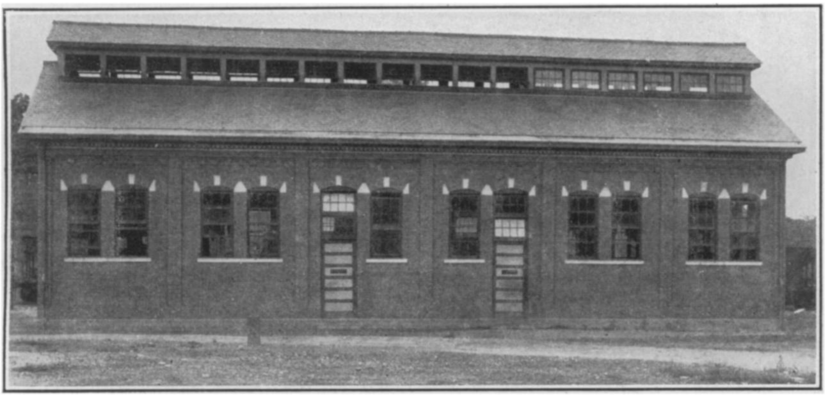


A. OLD-STYLE, CHEAPLY CONSTRUCTED, AND NEGLECTED COMPANY HOUSE.

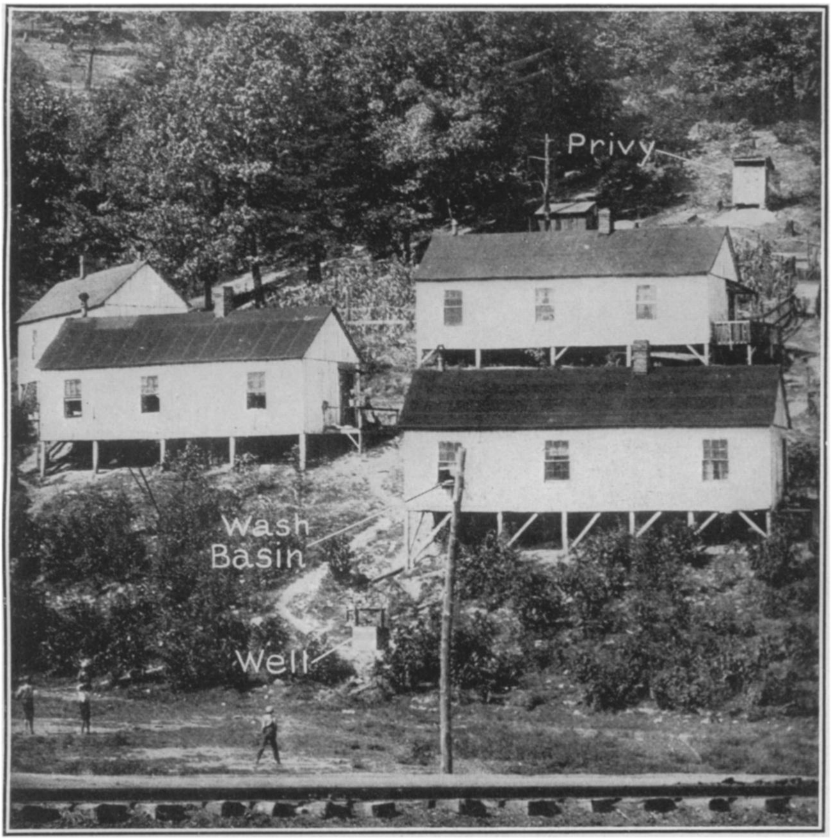


B. THREE-ROOM MINER'S COTTAGE AT DEWMAINE, ILL.

FIG. 14.



A. CHANGE AND WASH HOUSE AT EDGEWATER, ALA



B. INSANITARY ARRANGEMENT OF WELL, HOUSE, AND PRIVY.

FIG. 15

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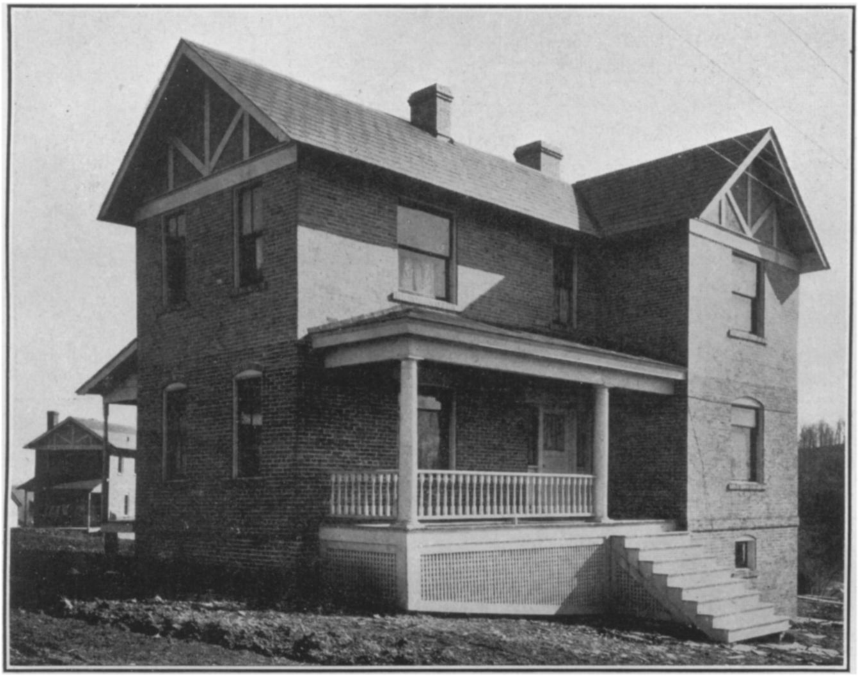
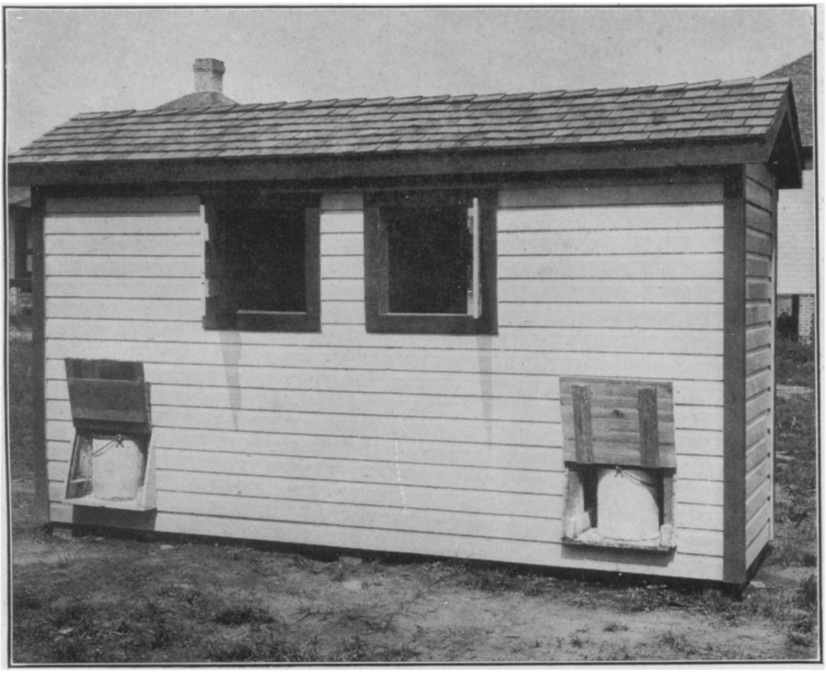


A. MINER'S BRICK HOUSE AT MARIANNA, PA.



B. REAR VIEW OF COMBINATION COAL BINS AND PRIVIES FOR TWO DWELLINGS. THE LOWER DOORS ARE SET AT AN ANGLE SO AS TO CLOSE TIGHTLY.

FIG. 16.

investments are expected to offer a fair and reasonable return. It is gratifying to learn that some of the mining companies do not consider it good policy to realize as high a rate of interest as an independent realty company would be warranted in receiving. The bulletin recommends strict scrutiny of all expenditures involved and avoidance of fanciful and unnecessarily expensive buildings, so that the house rent may be reduced to a mimimum.

Selection of House.

Special pains should be taken in the selection of living quarters, no matter how humble they may be, as they constitute our abode for the greater part of our life. There is an old but true proverb: "Where the sun does not enter the doctor surely will." Dark, gloomy, and damp houses should be avoided; moldy spots on the walls or ceilings and a close, musty odor indicate dampness; and cheap rents should prove no inducement to occupy such quarters. Leaky roofs, gutters, and drain spouts, or a pile of ashes against a brick wall may keep the house damp and the cause should be promptly removed. In all such instances, as well as in the occupancy of recently constructed houses, it is very essential to dry out the house by heat and open windows, selecting for this purpose clear, dry days. Pettenkofer has calculated that 10,000 gallons of water are incorporated in a house requiring 100,000 ordinary sized bricks.

Since we know that the mortality from contagious diseases increases in proportion to the number of inmates of the rooms, hygiene requires that even the most modest dwellings should afford sufficient room to prevent overcrowding.

Construction of House.

Type of construction.—The type of construction of houses will depend on whether use is to be made of existing dwellings, or new dwellings of a temporary or permanent character are to be erected, and whether these are to be for family use or for unmarried men or women.

Choice of building material.—The choice of building material depends largely upon its availability and cost in the respective localities, the estimated life of the buildings, and climatic conditions. Frame construction is perhaps most commonly employed, although brick and sand or limestone are often used for exterior walls if the material is more readily available. Terra cotta in the form of hollow blocks have come into use for interior partitions and have recently been successfully employed for exterior walls in the construction of suburban houses. Such exterior walls are stuccoed with a cement mixture, which may be colored any agreeable shade and should be waterproofed with some of the approved compounds added while

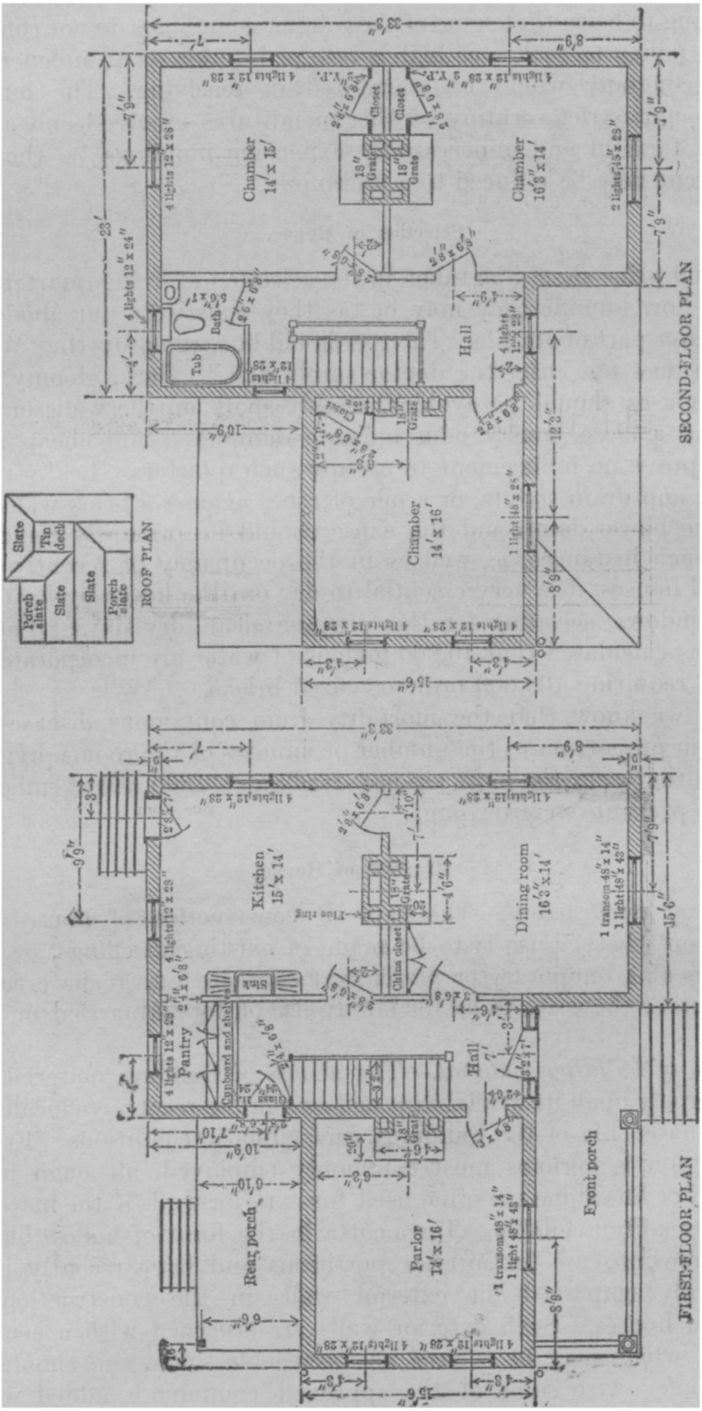
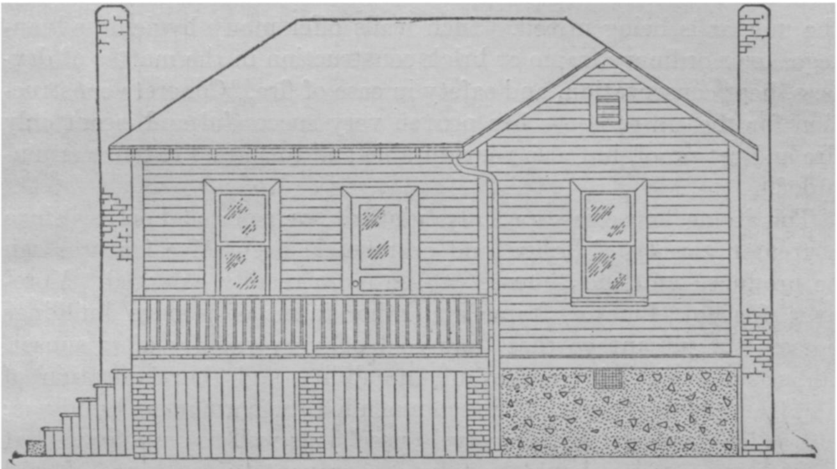
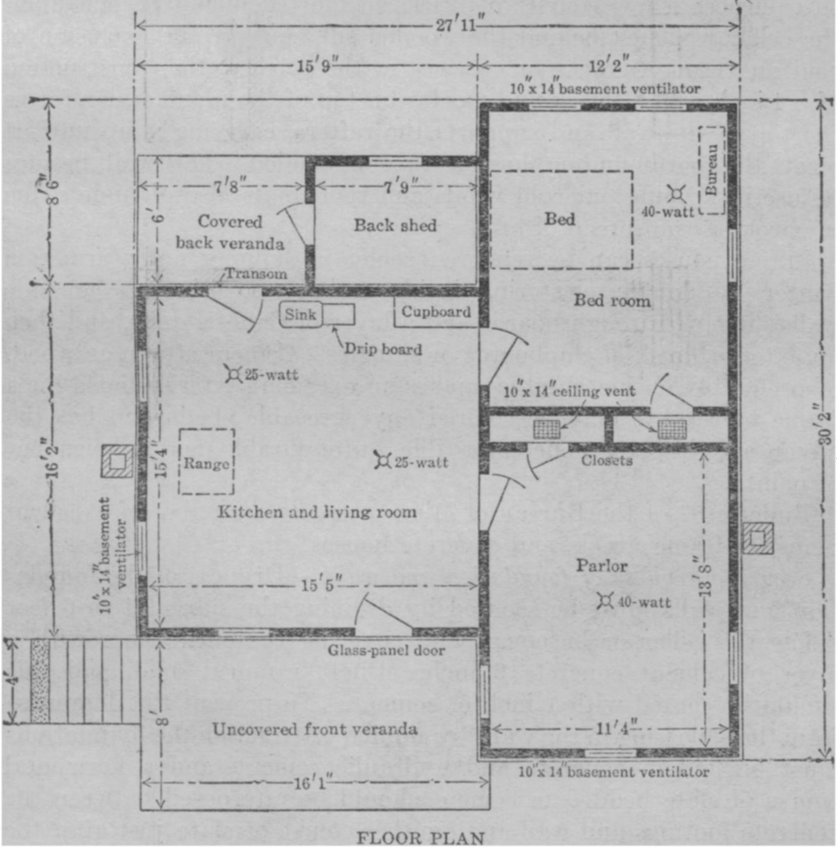


FIG. 17.—Floor plans of two-story brick house. (Bulletin 87, U. S. Bureau of Mines.)



FRONT ELEVATION



FLOOR PLAN

FIG. 18.—Plan and elevation of miner's frame cottage. (Bulletin 87, U. S. Bureau of Mines.)

the mortar is being mixed. Such walls offer many hygienic advantages over ordinary frame or brick construction in the matter of dryness, heat conservation, and safety in case of fire. Concrete construction for the entire house has proven very successful and is not only fire and rat proof, but also very durable and to a great extent verminproof.

The frame house is especially adapted for isolated houses, since a greater variety of design and economical decorative features can be produced and such houses can be more readily enlarged. Moreover, for hot climates, frame and other forms of wooden buildings possess the advantage that they cool off very rapidly after sunset. On account of their greater inflammability and short duration of life, frame houses can not be recommended for permanent buildings; but as long as they are extensively used, it is well to emphasize that special precautions should be taken to prevent the entrance of cold winds at the junction of the frame walls and the foundation. For this purpose a few courses of bricks in mortar should be laid upon the cellar wall just behind the wooden sill, and for the exclusion of cold air through cracks or crevices in the cornice, the construction of a 4-inch wall of brick and mortar on top of the plank which forms the top of the wall and supports the rafters, carrying it up until it meets the roof bounding, has been recommended. This wall, besides its use in keeping out cold winds and rodents, is also of some value in checking the spread of fire.

Frame houses can be rendered cooler in summer and warmer in winter by double plastering inside and by covering the outside walls, first with rough boards and a layer of Cabot's quilt, and then an exterior finish of clapboards or shingles. Cement stucco on wood, or preferably on metal laths, makes an excellent exterior finish for a frame house. It may be colored any agreeable shade and has the advantages of being noncombustible, quite durable, and independent of paint.

Bulletin 87 of the Bureau of Mines presents a number of excellent plans for frame, brick, and concrete houses.

Securing dryness of foundation and walls.—Dryness of the foundation and walls must be secured by draining the subsoil 4 to 6 feet below the cellar or basement and covering the entire floor with a layer of cement concrete 6 inches thick, rammed solid, and this should be coated with 1 inch of cement. To prevent the dampness from the soil rising in the walls by capillary attraction the foundations must be laid in concrete and hydraulic cement, and a horizontal course of slate bedded in cement should be interposed between the concrete footings and wall and another course of slate just after the foundation walls pass above the ground level. The upper damp-proof course may consist of vitrified hollow brick. Some architects recommend damp-proof courses of tarred-felt asphalt or sheet lead.

The exterior walls of a house, whenever practicable, should be separated from the ground by an "open area," extending from the foundation upward; but where this can not be done, a "dry area" may be formed by constructing a hollow wall to the ground level, provided with the usual damp-proof courses, and, if springy, also with a subsoil drain at the bottom, at the same time protecting the wall in contact with the ground with a coat of slate embedded in cement. In localities with considerable rainfall it will be well to protect the side or rear walls of a rough brick building from driving rains with a coat of cement, mineral paint, tar, or glazed tiles. In recent years the application of a coat of waterproof paint under the plaster on the inside of the exposed wall has replaced most of the other methods.

Roofs and roofing.—A good dry roof is another important factor, because water often gets to the walls through a defective roof and the whole house becomes damp. Metallic roofs with a sufficient pitch are most commonly used and usually secure this needed protection, but as they heat very rapidly a tin roof should be painted white and a good nonconductor should intervene. There should also be an air space of 2 or 3 feet between the upper ceiling and the roof, and this space should be ventilated. All tin roofs should have flat soldered seams for a distance of 5 or 6 feet back from the gutter, so that if the gutter is stopped up the water can not back up under the seams. Slate, cement slag, and tiled roofs, when properly constructed, afford protection against dampness, fire, and heat. In rural districts wooden shingles are still extensively used, and such roofs when treated with creosote and covered with rubber or metallic paint last for about 20 years.

Floors.—Hygiene demands that the floors should be impervious to dirt, moisture, and germs, and should therefore be well seasoned, tongued and grooved, and closely matched; veranda or exposed floors should be laid in white lead. There should be a subfloor of rough pine with a double layer of Florian building paper between. In warm climates cement or "granito" floors may be advantageously used.

Ceiling space.—As a filler for the ceiling space, with a view to deadening sounds and as a protection in case of fire, special hollow bricks, dry cinders, clean, dry mortar, and peat impregnated with milk of lime have been used to good advantage. Expanded metallic lathing is preferable to wood.

Basements.—Basements are always desirable, even in small houses, for storerooms, heating plants, and laundry. The basement should be at least 8 feet from floor to ceiling, not over one-half below ground, well lighted, and with all precautions taken to prevent odors from the kitchen, etc., passing into the upper stories.

Rooms and windows.—The rooms of the first floor should be from 10 to 10½ feet high and should be liberally supplied with windows. No room should have a borrowed light. Sleeping porches are strongly recommended. Interior finish and decorations should not be such as will serve as dust and germ traps. Cornices and projections on ceilings and walls, the moldings of door and window frames, wardrobes, carpet, and cumbersome draperies all tend to collect dust and microorganisms.

Ventilation.

The importance of adequate ventilation has been emphasized in the discussion of camps. Ventilation in residences must depend principally upon the opening of windows. In rooms heated with direct radiation the fresh air preferably should be admitted above the heads of the occupants, either by means of a register in the wall or by the insertion of a louver or swinging window pane in one of the windows, an upward direction being given to the air so that it may impinge upon the ceiling, mix with and be warmed by the heated air, fall gently into all parts of the room, and be gradually removed by means of the chimney flue or any other outlet.

Open windows are especially desirable at night, as nothing can take the place of pure fresh air in small quarters. This may be effectively accomplished without the danger of drafts by opening the windows from top and bottom. Night air, contrary to popular opinion, is not unwholesome. The windows, however, should be screened against mosquitoes and flies in the summer time. Open windows are even more essential in cold weather, because of the additional pollution from lights and fires.

There are many families who very properly insist upon having a room reserved exclusively for a sitting room or parlor, which is most commendable if the bedrooms are large enough to afford 500 cubic feet of air space for each occupant. If they are not, the sitting room or parlor should be used as a bedroom.

Unfortunately there are a number of families, who for various reasons are obliged to live, cook, and sleep in one room and for whom the question of fresh air is therefore of vital importance. Such families should not hesitate to avail themselves of the benefit of fresh air by means of open windows, especially since medical experience has demonstrated the advantages of fresh and even cold air in the treatment of consumption and pneumonia, provided the body is kept warm by sufficient bedclothes.

Temperature.

The most healthful room temperature in cold weather is between 65 and 70 degrees, as overheated rooms predispose to colds and respiratory diseases, and should be avoided. Heat should be supplied as uniformly as possible and the air of habitations, instead of being vitiated by the products of combustion, should be improved by the heating apparatus. Any heating system must also take into consideration the question of supplying sufficient humidity in the winter.

Lighting.

Electricity is in every way superior to gas and other illuminants in the lighting of houses, because there is little danger from fire, there are no products of combustion, hence no pollution of the air, nor are the temperature and humidity of the rooms affected to any perceptible extent. These advantages over gas are of special importance to the inmates of buildings where the question of fresh air and temperature play an important rôle. Next to electric light, gas, especially in connection with a Welsbach or Siemens burner, offers the best choice; in the absence of either, high-grade kerosene should be preferred over other illuminants. Acetylene gas has come into deserved prominence.

House Drainage and Plumbing.

The requisites for proper house drainage, where there is a general sewerage system, are as follows:

1. Water-closets, wash basins, bath and laundry tubs, and kitchen sinks.
2. A perpendicular system of piping known as the soil and vent pipes with which the foregoing fixtures are connected.
3. The house drain, which is a nearly horizontal pipe and connects with the sewer.

Simplicity of the drainage system is of the utmost importance; hence all the fixtures necessary for the comfort of the inmates of the house should be placed in close proximity to the soil pipe, drained and trapped separately into it. When a fixture must be placed some distance from the soil pipe, ample fall must be allowed for the connecting waste pipe. All of the plumbing should be exposed. Where possible, bathrooms should have an impermeable floor. Whenever the kitchen and pantry drains cannot be provided with a very rapid fall, the congealing of the grease is likely to obstruct the drain. To remedy this condition, the drain should be provided with a "grease interceptor" or flushed several times a week with a hot 4 per cent solution of caustic potash or soda. The soil pipe should never be less than 4 inches in diameter. Individual fixtures should be trapped to prevent the escape of sewer gas into the rooms, but it is not necessary to have a main trap for the entire house if the plumbing is of substantial character. Where there is no such trap, the ventilation of the main sewers is promoted through the use of the vents at the top of soil pipes. Soil pipes and the general plumbing system should be tested before the house is occupied and thereafter in the event of suspicion of defect.

Rat Proofing Premises.[1]

This measure is highly desirable, both for sanitary and economic reasons, and especially should be employed in communities along the seaboard, on account of the possible introduction of bubonic plague at such ports.

Rat proofing serves the double purpose of eliminating rat harborage and protection of food supply from the depredations of rodents. In buildings used for residential purposes only it is generally sufficient to consider merely the elimination of rat harborage without any special reference to the protection of food supply. This can be accomplished in two ways, in so far as it applies to floor area; first, the elevation of the building to heights varying from 1 to 3 feet, according to the dimensions of the building, with underpinning free and the space beneath the building kept clear of loose materials; or as an alternative method, by having the foundation wall at the edge of the building closely fitting the floor and extending 2 feet into the ground.

If rat proofing is accomplished by elevation, it is especially necessary to prevent access of rats to double walls. This is accomplished by obliterating hollow space with a concrete fill or bricks extending 1 foot upward from the floor. Ordinarily this measure will suffice in the event of rodent infestation of buildings where a large supply of foodstuffs does not make for additional attraction to rats.

Buildings where foodstuffs are prepared or stored in considerable quantities, such as groceries, bakeries, meat markets, stables, and the like, require measures not only for the prevention of the harborage of rats, but likewise to prevent their temporary incursion in search of food. In this class of structures it is preferable that the floor be of concrete, protected on all sides at the edge by a wall extending 2 feet under the ground, this in order to prevent rats burrowing under the edge of the concrete. Hollow wall or ceiling space should be avoided in these structures. The walls should be of solid masonry, brick or concrete, but if of frame the entrance to the space should be protected by a brick or concrete fill extending from the floor upward 1 foot.

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[1] For details of rat-proof construction see various publications of United States Public Health Service on this subject.

Additional precautions are necessary, especially in places where foodstuffs are kept, to prevent the admission of various species of climbing rats. Consequently ventilators and drains and other similar openings should be screened with durable material, preferably not less than 12-gauge wire, mesh not exceeding one-half inch. The premises should be kept free of loose material, which might serve as a harborage for rats. This especially applies to loose lumber, barrels, boxes, etc. If retained on the premises, such articles should be elevated not less than 2 feet from the ground. Plank walks are favorite harboring places for rats and should be avoided, the necessary walks being made of concrete or brick. Garbage should be carefully deposited in a water-tight can and should be kept covered, especially during the night.

Control of Other Vermin.

Not only will the types of construction above outlined prevent rats, but they will also tend to prevent other vermin. For this latter purpose, however, the interior of dwellings will have to receive extra attention. Due care should be taken in the selection of materials for interior finishing, not only to obviate breeding places for vermin, but to facilitate periodic flushing with solutions and fumigation with gases.

Where the walls and floors are of wood construction the use of an oil dressing regularly after scrubbing keeps out vermin as well as preserving the wood.

After the house is occupied special attention must be paid to the exclusion and destruction of insects, for apart from the discomfort produced, disease germs are conveyed by flies, mosquitoes, fleas, and the body louse, and probably by bedbugs and roaches.[1] Flies may carry the infections of typhoid fever, dysentery, and other intestinal diseases and possibly also pink-eye, purulent ophthalmia, poliomyelitis, anthrax, glanders, erysipelas, and other diseases. The flea from infected rats, squirrels, and other rodents may convey the germs of plague. The body louse is believed to be the chief carrier of typhus or spotted fever, and bedbugs have been incriminated in the transmission of relapsing fever, tuberculosis, and other infections. It has been proven that mosquitoes are the intermediate host of the germs of malaria and yellow fever.

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[1] A. Celli of Rome in 1888 (Boll. dell. soc. Lancis. degli ospidali di Roma, May, 1888) demonstrated that the germs of tuberculosis and other disease germs may retain their vitality after passing through the intestinal tract of flies. Spillmann and Haushalter (Comptes Rendues; 105 p. 352) pointed out that flies caught while feeding upon the expectoration of a consumptive invariably contained living germs. E. Hoffmann (D. Med. Zeitung, 1888, No. 57) not only confirmed these observations, but also found the germs in the fly spots on the wall of a room occupied by a consumptive. Kober (report of the Health Officer, District of Columbia, 1895) in his investigations of a typhoid epidemic in Washington pointed out a number of house infections which he attributed to the agency of flies carrying the germs from typhoid stools and infected sources to the food and milk supply.

HOUSE CLEANING AND GENERAL CLEANLINESS.

The question of systematic house cleaning is important. Hygiene condemns all carpets and interior finishes which serve as dust and germ traps, and the object of house cleaning must primarily be to get rid of the dust and germs. Vacuum cleaners are doubtless the most efficient means for this purpose. When they are not available, sweeping may be effective. It is a good plan to open the upper windows, but to keep the doors leading into the hall closed, so that the dust may not be wafted back into the house. The dusting should always be done with a soft, damp cloth, frequently changed. A dry dusting cloth, however, may be chosen when the articles are liable to be injured. Feather dusters are useless in the inside of the house, as they do not remove the dust, but simply displace it. If the cracks in floors have been neatly filled up and the floors oiled or waxed, they can after being swept be cleaned with a damp cloth. This method is more effective than the tiresome scrubbing of unoiled floors. The kitchen, cooking, and eating utensils need special care, as unclean food and utensils are often the cause of cholera morbus and diarrheal diseases.

Every effort should be made to have clean and cool storage facilities for food, and all perishable food, especially milk for infant feeding, should be kept on ice whenever the temperature is above 50 degrees.

Poultry, pigeons, and household pets, such as dogs, cats, and parrots, ought not to be kept in the rooms, as they contaminate the air, harbor insects, and may even convey disease germs. Parrots suffer at times from a pulmonary disease, which is transmissible to man, and certain forms of tape worm, skin disease, and itch may be conveyed by dogs and cats.

There should be no accumulation of rubbish within or without the house, and the outhouses should be kept in a clean and sanitary condition.

A good housewife can not only accomplish a great deal for the health, but also for the comfort and morals of the family. General order and neatness, clean, white, washable curtains, some potted plants, and a few suitable pictures, together with a cheerful and refined atmosphere, will do much to attach husbands and sons to their homes.

As a matter of fact, much may be done to transform undesirable living quarters into healthful homes, while filth, neglect, and slovenly housekeeping often convert even structurally good houses into veritable hotbeds for disease. So, too, persons with delicate constitutions may, by attention to the laws of health, attain to a good old age, while the physical giant, by a reckless life, soon undermines his general health and goes to a premature grave.

LOCAL LEGISLATION.

In the establishment of new residence areas for industrial plants, a splendid opportunity is given for the adoption of good sanitary legislation, which may cover many of the points brought out in the above report. The advice of skilled sanitarians should be employed in drawing up such legislation. Consideration should be given to the adoption of provisions for full-time health officers for these areas or for the counties in which they are located, and the existing public-health organizations should be strengthened to cope with the new problems arising out of the present stress on industry.

In submitting the above report, your committee is aware of the fact that it must be supplemented by detailed plans and specifications where the building of a new village or industrial community is to be undertaken, but it is thought that an understanding of the underlying principles and of the recent developments in sanitary knowledge will do much to focus attention upon the subject.